

"The State of the California Current in 1999-2000: Forward to a New Regime?"

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Text:

Following an extended absence, the reintroduction of ocean color sensors to space in the mid to late 1990's provided an invaluable opportunity for evaluating the biological impact of the 1997-99 El Niño/La Niña events in the California Current System (CCS). DiGiacomo (1999) used OCTS (1996-97) and SeaWiFS (1997-98) chlorophyll-a data, complemented by other satellite and field measurements, to describe how a combination of atmospheric and oceanic forcing led to large reductions in coastal CCS phytoplankton biomass during the 1997-98 El Niño relative to the preceding year. As the accuracy of ocean color data is always of potential concern, particularly in coastal zones, OCTS/SeaWiFS data were compared to CalCOFI cruise data from October 1996 through April 1999 to examine their overall correspondence, as well as identify relevant trends (Figures pmd1, pmd2, pmd3).

Generally speaking, satellite-derived chlorophyll-a values were comparable to ship station data (e.g. Figure pmd1). For the CalCOFI time series in question, rms errors ranged from 0.20 to 1.16, with most values under 0.5. The largest rms errors were observed during early periods of strong upwelling (e.g. April 1997, 1999), associated with higher chlorophyll-a values. The good overall correspondence between ship and satellite-derived chlorophyll-a values can also be seen in both the relative trends and mean absolute values for inshore (Figure pmd2) and offshore (Figure pmd3) waters over this same time period. Where differences exist in these chlorophyll-a values, it is usually a case of the satellite data underestimating the ship data. Kahru and Mitchell (1999) indicated that the SeaWiFS OC2-v2 algorithm can underestimate intermediate chlorophyll-a values (~ 1 to 10 mg m^{-3}); this is seemingly the case with the OCTS

algorithm as well. This also appears to explain why the chlorophyll-a differences are more pronounced inshore (Figure pmd2) versus offshore (Figure pmd3), where chlorophyll-a values are generally less than 1 mg m^{-3} .

Interannual comparisons of chlorophyll-a, temperature, and nitrate data from corresponding seasonal cruises (e.g. 9610 vs. 9709) revealed a number of important trends. CalCOFI cruises 9709 and 9802, during the peak of the El Niño, had lower mean chlorophyll-a and nitrates, and higher mean temperature than the 9610 and 9702 cruises, respectively, both inshore (Figure pmd2) and offshore (Figure pmd3). Conversely, during CalCOFI cruise 9904, when La Niña conditions prevailed, mean chlorophyll-a and nitrate values were higher, and the mean temperature was lower relative to the two preceding spring cruises, i.e. 9804 and 9704 (Figures pmd2, pmd3). Also of interest in the April 1997-99 series is the reduction observed in mean offshore chlorophyll-a (and nitrate) values during April 1998, presumably at least partly attributable to reduced coastal upwelling.

Acknowledgements:

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References:

DiGiacomo, P. M., Satellite Observations of Phytoplankton Variability in the California Current System: El Niño to Eddies, Ph.D. Dissertation, 186 pp., University of California, Los Angeles, 1999.

Kahru, M. and B. G. Mitchell, Empirical chlorophyll algorithm and preliminary SeaWiFS validation for the California Current, *International Journal of Remote Sensing*, 20, 3423-3429, 1999.

Figure Captions:

Figure pmd1. Comparison of *in situ* and satellite chlorophyll-a values, coverage overlaps within one week. (a) CalCOFI cruise 9702 (Line 77 to 93 stations; 0-30 m station mean) data versus weekly-averaged OCTS (Version 4, Level-3) data. (b) CalCOFI cruise 9901 (line 77 to 93 stations; 0-30 m station mean) data versus weekly-averaged SeaWiFS (Version 2, Level-3) data. Depth bins of 0-30 m were used to encompass at least one attenuation length.

Figure pmd2. (a) Comparison of mean inshore satellite and *in situ* chlorophyll-a values, coverage overlaps within two weeks. Satellite data were extracted at corresponding CalCOFI stations and for the entire region that encompassed those stations. The "inshore" designation refers to CalCOFI stations (Lines 77 to 93) less than approximately 130 km offshore. Weekly-averaged OCTS (Version 4, Level-3) data used for CalCOFI cruises 9610 to 9707; weekly-averaged SeaWiFS (Version 2, Level-3) data used for CalCOFI cruises 9709 to 9904. (b) Mean inshore temperature and nitrates from CalCOFI station (0-30 m mean) data.

Figure pmd3. (a) Comparison of mean offshore satellite and *in situ* chlorophyll-a values, coverage overlaps within two weeks. Satellite data were extracted at corresponding CalCOFI stations and for the entire region that encompassed those stations. The "offshore" designation refers to CalCOFI stations (Lines 77 to 93) greater than approximately 130 km offshore. Weekly-averaged OCTS (Version 4, Level-3) data used for CalCOFI cruises 9610 to 9707; weekly-averaged SeaWiFS (Version 2, Level-3) data used for CalCOFI cruises 9709 to 9904. (b) Mean offshore temperature and nitrates from CalCOFI station (0-30 m mean) data.

Figure 1

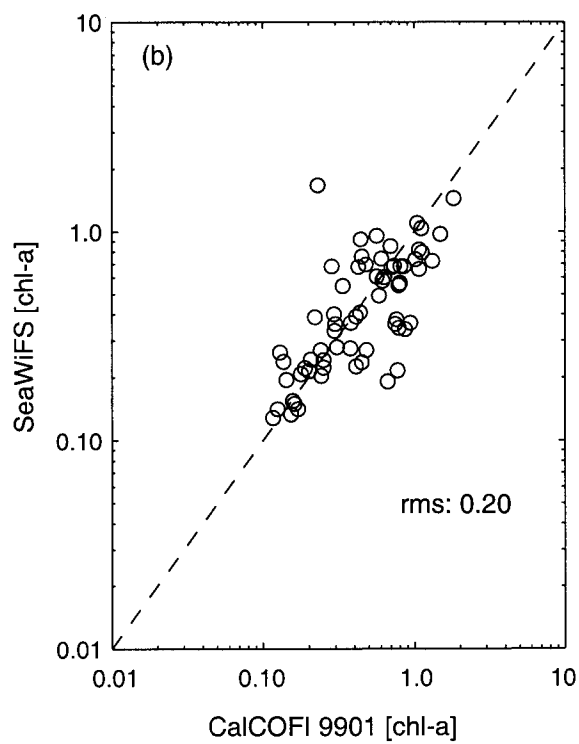
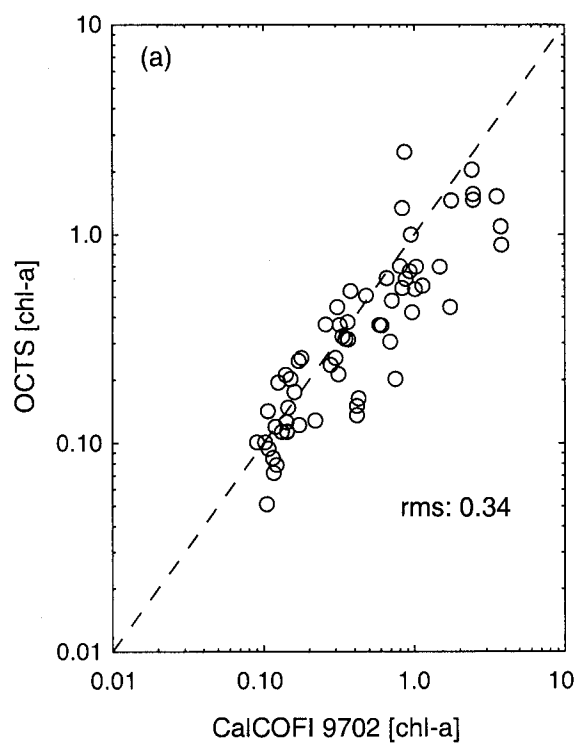


Figure 2

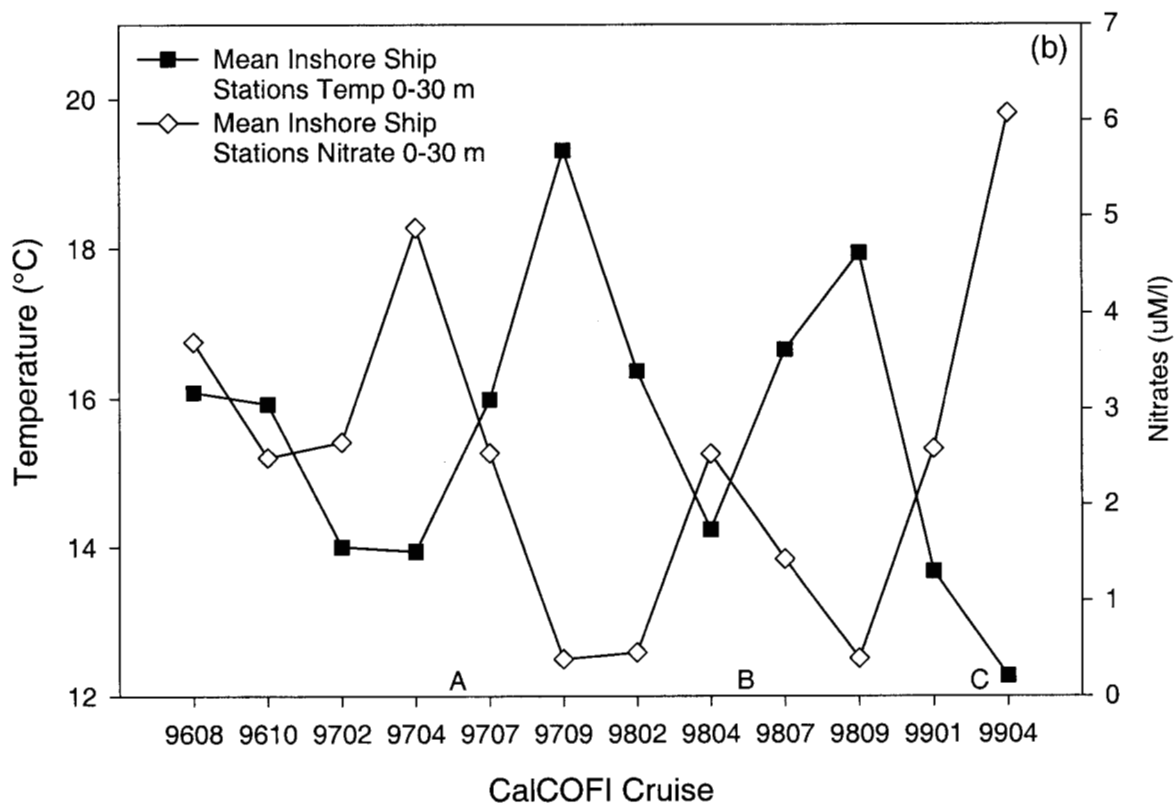
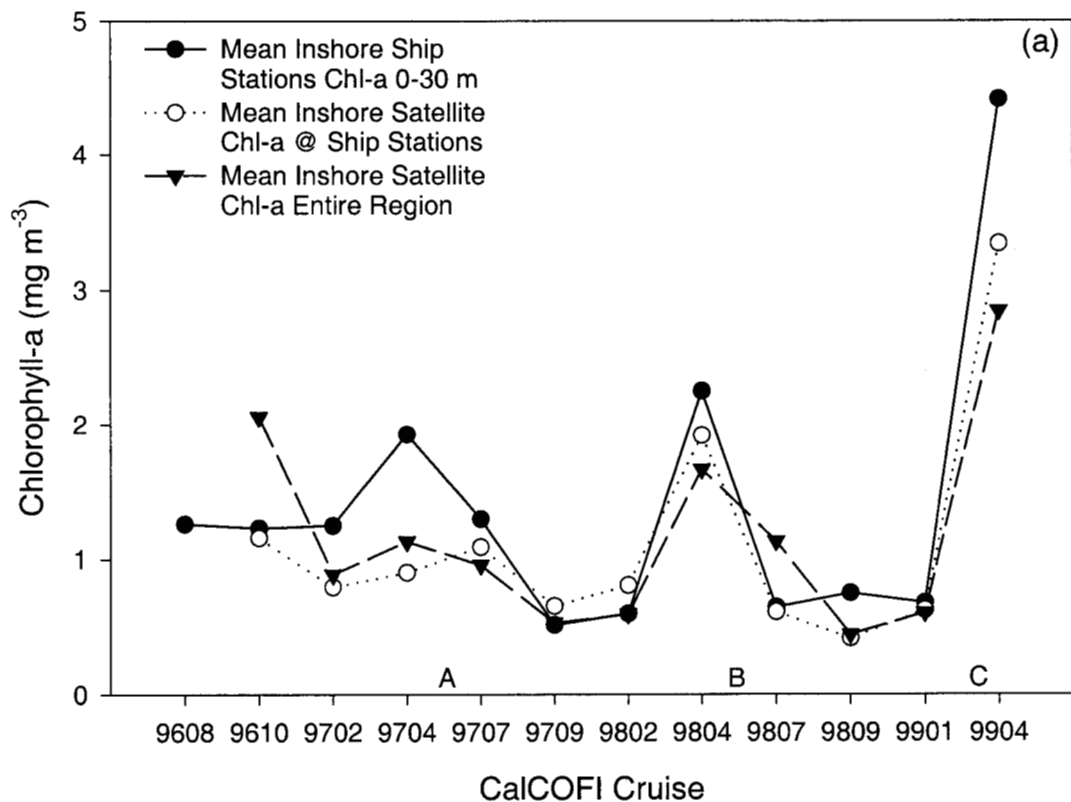


Figure 3

